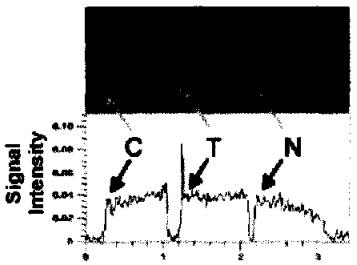
2:45 p.m.

865-4 **Magnetic Resonance Imaging and Quantification of Targeted Drug Delivery to Vascular Cells With Paramagnetic Perfluorocarbon Nanoparticles**

Gregory M. Lanza, Dana R. Abendschein, Xin Yu, Patrick M. Winter, Michael J. Scott, Ralph W. Fuhrhop, David E. Scherrer, Samuel A. Wickline, *Washington University, St. Louis, Missouri.*

Stent-based drug delivery systems produce high local intimal drug concentrations with inhomogeneous penetration of drug into the media. We suggest that therapeutic paramagnetic perfluorocarbon-based nanoparticles containing gadolinium chelates that are targeted to vascular smooth muscle cells can provide highly localized antiproliferative benefits plus quantification of local drug delivery. Methods: Anti-TF paramagnetic nanoparticles incorporating paclitaxel were targeted to vascular smooth muscle cells (VSMC), exposed for 30 minutes, and cellular proliferation (cell counts) was determined 3 days later. Targeted paclitaxel-nanoparticles bound to TF epitopes on VSMC were imaged with 1H and 19F MRI at 4.7 T. Results: VSMC proliferation was decreased by over 80% ($p<0.05$) by targeted paclitaxel. Molecular imaging of tissue-factor expression with paramagnetic nanoparticles at 4.7T MRI provided robust sub-voxel detection of a submicron layer of targeted therapeutic delivery.



C=Control, T=Targeted, N=Nontargeted

In addition, low-resolution 19fluorine spectroscopy confirmed drug delivery and was linearly correlated with nanoparticles concentrations. Conclusion: Ligand-targeted paramagnetic perfluorocarbon-based nanoparticles are unique molecular imaging agents that potentially can be employed for targeted delivery of antiproliferative agents to treat post-angioplasty restenosis, improve stent decision strategies, and provide prognostic information for post-procedure clinical management.

3:00 p.m.

865-5 **Associations of Atherosclerotic Risk Factors and Coronary Artery Disease With Plaques in Thoracic and Abdominal Aorta Detected by Magnetic Resonance Imaging**

Yukihiko Momiyama, Hiroaki Taniguchi, Reiko Ohmori, Akiko Hara, Kou Arakawa, Noboru Kameyama, Kiyoshi Nagasawa, Masayoshi Nagata, Haruo Nakamura, Fumitaka Ohsuzu, *National Defense Medical College, Saitama, Japan, Iruma Heart Hospital, Saitama, Japan.*

Background: Recently, MRI can detect plaques in aorta (Ao). Using MRI, we assessed the associations of risk factors and CAD with plaques in thoracic descending (Td) and abdominal (Ab) Ao.
Methods: MRI was performed on Signa 1.5T by double inversion recovery FSE sequence in 68 patients (pts) who had CAG. T2W and PDW images of Ao were obtained every 12 mm with 4 mm thick slice. In each pt, we assessed 9 slices of Td and 9 slices of Ab Ao. Each slice was scored (0-4 point) by plaque extent.
Results: Of 68 pts, 51 (75%) had CAD (>50% stenosis). In MRI, plaques in Td and Ab Ao were found in 36 (53%) and 59 (87%) pts. Plaque extents (sum of scores) in Td and Ab Ao were associated with age and hypertension. Degree of smoking correlated with plaque extent in Ab Ao ($r=0.43$, $p<0.005$) but not in Td Ao. In contrast, serum LDL cholesterol level correlated with plaque extent in Td Ao ($r=0.43$, $p<0.005$) but not in Ab Ao. In multivariate analysis, smoking and hyperlipidemia were associating factors for plaques in Ab and Td Ao, respectively. Plaques were more prevalent in Ab than in Td Ao. However, of 59 pts with plaques, 9 had more plaques in Td than in Ab Ao and had higher LDL level ($p<0.001$) compared with 50 pts with more plaques in Ab than in Td Ao. Of 9 pts with more plaques in Td Ao, 7 (78%) had LDL >150 mg/dl, whereas only 9 pts (18%) with more plaques in Ab Ao had it. Plaques with hyperintense on PDW and hypointense on T2W images are recognized as lipid-rich. Among plaques, 11% in Td and 31% in Ab Ao were lipid-rich, and these correlated with LDL level ($r=0.51$). Inflammatory markers (CRP and fibrinogen) correlated with total Ao plaque extent (Td+Ab) ($r=0.41$ and $r=0.44$). Although plaque extent in Ab Ao correlated with the numbers of coronary stenotic segments, CAD was predicted better by assessing both Td and Ab Ao than only Ab Ao. The finding of Ao plaques >3 slices could predict CAD with 78% sensitivity and 65% specificity.
Conclusion: MRI is useful to detect plaques in Td and Ab Ao noninvasively. Age and hypertension were related to plaques in both Ao, but smoking and hyperlipidemia were related to plaques in Ab and Td Ao, respectively. Td and Ab Ao may have different susceptibility to risk factors. CAD was related to Ab Ao plaques but could be predicted better by assessing both Ao.

3:15 p.m.

865-6 **Comparison of High Resolution Magnetic Resonance Imaging, Intravascular Ultrasound, and Digital Subtraction Angiography for Assessment of Atherosclerotic Plaques in Humans**

Johannes Rieber, Oliver Meissner, Johannes Rieger, Federico Tato, Thomas Schiele, Klauss Juergen Pfeiffer, Ulrich Hoffmann, Volker Klauss, *Medical Clinic University of Munich, Munich, Germany, Intitute for Radiology University of Munich, Munich, Germany.*

High-Resolution Magnetic Resonance imaging (MRI) is a promising method for noninvasive in vivo assessment of atherosclerotic lesions. intravascular ultrasound (IVUS) has demonstrated its superiority in quantification of luminal diameters as well as vessel wall dimensions.
The aim of the present study was to compare MRI, DSA and IVUS for quantification of atherosclerotic lesions in vivo.
Methods: In patients scheduled for PTA of the femoral artery MRI (Siemens Magnetom Vision, 1,5 Tesla) was performed using T1-,T2-weighted, 3D time-of-flight (TOF) and contrast enhanced MR angiography (MRA). Arteriography was done in standard multiplane DSA technique. IVUS (3.5F, 40MHz) images were recorded using a standardized motorized pullback system and were used as gold standard for qantification of lumen and vessel wall dimensions. MRA was used to allow for assignment of exact matching sites in all applied methods. Analyzed parameters comprised minimal luminal diameter, cross sectional vessel area, lumen area, plaque area, absence or presence of calcium and extent of calcification.
Results: 50 femoral artery segments were included into this study. The segment showing the minimal luminal diameter could be retrieved by all methods with high accuracy (agreement by all methods 97%). In segments without relevant plaque burden (n=20) a good correlation of lumen dimensions was observed by IVUS, DSA and TOF ($r=0,87$; $r=0,85$). Combination of TOF and fat saturated T1-weighted sequences had a high sensitivity (92%) for the detection of calcifications within the vessel wall. Only a moderate correlation of vessel area and plaque area measurements ($r=0,70$; $r=0,72$) by MRI and IVUS could be achieved using TOF and T2-weigthed sequences.
Conclusion: Our initial findings suggest that MRI is an encouraging tool for noninvasive in vivo assessment of atherosclerotic lesions. There was a good correlation between luminal measurements by MRI and IVUS. Due to the difficulty in discriminating vessel wall from adjacent connective tissue cross sectional vessel measurements showed a moderate correlation. Technical development and further studies will help to improve noninvasive vessel wall characterization.

POSTER SESSION

1211 Echo Assessment of Coronary Flow Reserve

Tuesday, March 19, 2002, 3:00 p.m.-5:00 p.m.
Georgia World Congress Center, Hall G
Presentation Hour: 4:00 p.m.-5:00 p.m.

1211-51 **Transthoracic Doppler Echocardiography Versus Exercise 201-Tl Single Photon Emission Computed Tomography in Physiological Assessment of Intermediate Coronary Stenosis**

Masao Daimon, Hiroyuki Watanabe, Hiroyuki Yamagishi, Kumiko Hirata, Youichi Kuwabara, Nobuyuki Komiyama, Issei Komuro, Junichi Yoshikawa, *Chiba University, Chiba, Japan, Osaka City University, Osaka, Japan.*

Background. Discrepancies exist between angiographic and physiological estimates of coronary lesion severity, and coronary flow reserve (CFR) measurement provides physiological information on the severity of coronary artery stenosis. However, noninvasive CFR measurement by transthoracic Doppler echocardiography (TTDE) for physiological assessment of angiographically intermediate coronary stenosis (40% to 70% stenosis) has not ever examined. We evaluated the value of CFR determined by TTDE for physiological assessment of intermediate coronary artery stenosis compared with exercise 201-thallium single photon emission computed tomography (SPECT). ***Methods*** . We studied 47 patients undergoing diagnostic quantitative coronary angiography (QCA) for assessment of the intermediate-severity LAD stenosis (mean QCA percent diameter stenosis, 57±9%, range 41 to 69%). The flow velocity in the distal LAD was measured using high-frequency transducer both at rest and during intravenous infusion of adenosine. CFR was calculated as the ratio of hyperemic to basal mean (mean CFR) and peak (peak CFR) diastolic flow velocity. CFR measurements by TTDE and QCA date were compared with the results of SPECT. ***Results.*** Complete TTDE data were acquired for 45 of 47 study patients. Of these 45 patients, SPECT confirmed reversible perfusion defects in the LAD territories in 11 patients. The best cutoff values and its sensitivity and specificity for predicting a reversible perfusion defect were, 1) peak CFR of 2.0 with 91% and 85%, 2) mean CFR of 2.0 with 82% and 91%, and 3) 56% diameter stenosis with 73% and 76%, respectively. ***Conclusion.*** Noninvasive measurement of CFR by TTDE highly correlated with SPECT for physiological assessment of the angiographical intermediate coronary artery stenosis.